CLAIMS

What is claimed is:

1. An engineered osteochondral graft for promoting the growth of cartilage in a patient at a defect site in need of repair, comprising a matrix block and a first population of MSCs, wherein said first population of MSCs are press-coated on a top surface of said matrix block, and said first population of MSCs forms a cartilage layer on said top surface of said matrix block.

2. The engineered osteochondral graft of **Claim 1**, wherein said matrix is biodegradable.

3. The engineered osteochondral graft of **Claim 2**, wherein said matrix is selected from the group consisting of demineralized bone matrix (DBM), biodegradable polymers, calcium-phosphates and hydroxyapatite.

4. The engineered osteochondral graft of **Claim 3**, wherein said matrix is a porous polylactic acid.

5. The engineered osteochondral graft of **Claim 4**, wherein said porous polylactic acid is D,D-L,L-polylactic acid.

6. The engineered osteochondral graft of **Claim 5**, wherein said matrix block is a D,D-L,L-polylactic acid polymer block of about 1 x 0.5 x 0.5 cm, said top surface of said matrix block is about 0.25 cm^2, said first population of MSCs is about 1.5 x 10^6, and said cartilage layer is about 1-1.5 mm thick.

7. The engineered osteochondral graft of **Claim 1**, wherein said matrix block has a shape compatible with said defect site.

8. The engineered osteochondral grafted of **Claim 1**, wherein said MSCs are isolated from a tissue selected from the group consisting of bone marrow, blood, periosteum, muscle, fat, bone and dermis.

9. The engineered osteochondral grafted of **Claim 8**, wherein said MSCs are isolated from bone marrow.

10. The engineered osteochondral graft of **Claim 1**, wherein said engineered osteochondral graft further comprises an osteoinductive growth factor in an amount sufficient enough to elicit osseointegration.

11. The engineered osteochondral graft of **Claim 10**, wherein said osteoinductive growth factor is BMP-2.

12. The engineered osteochondral graft of **Claim 1**, wherein said engineered osteochondral graft further comprises a second population of MSCs which are loaded in the remaining volume of said matrix block, and said second population of MSCs is in an amount sufficient enough to elicit osseointegration.

13. The engineered osteochondral graft of **Claim 12**, wherein said engineered osteochondral graft further comprises an osteoinductive growth factor in an amount sufficient to elicit osseointegration.

14. The engineered osteochondral graft of **Claim 13**, wherein said osteoinductive growth factor is BMP-2.

15. The engineered osteochondral graft of **Claim 1**, wherein said first population of MSCs are transiently or stably genetically engineered to express a gene product.

16. The engineered osteochondral graft of **Claim 15**, wherein said gene product is a member of the transforming growth factor-β superfamily.

17. A method of fabricating an osteochondral graft comprising the steps of contacting a top surface of a matrix block with a high-density pellet of a population of MSCs for a first period of time sufficient enough to form a cell-matrix structure, and culturing said cell-matrix structure in a chondrogenic differentiation medium for a second period of time sufficient enough to form a cartilage layer on said top surface of said matrix block, wherein said population of MSCs is an amount enough for the formation of said cartilage layer.

18. The method of **Claim 17**, wherein said chondrogenic differentiation medium contains a transforming growth factor.

19. The method of **Claim 18**, wherein said transforming growth factor is a member of TGF-β superfamily

20. The method of **Claim 19**, wherein said member of TGF-β superfamily is selected from the group consisting of TGF-β1, TGF-β3 and BMP-2.

21. The method of **Claim 17**, wherein said first population of MSCs is about 1.5×10^6 cells per 0.25 cm^2 of said top surface area.

22. The method of **Claim 17**, wherein said matrix block is a D,D-L,L-polylactic acid polymer block of about 1 x 0.5 x 0.5 cm, said top surface is about 0.25 cm^2, said population of MSCs is about 1.5×10^6, said first period of time is about 3 hours, said second period of time is about 3 weeks, and said chondrogenic differentiation medium contains about 10 ng/ml TGF-β1.

23. A method of promoting the growth of cartilage in a patient at a site in need of repair, comprising the step of implanting an engineered osteochondral graft at said site, wherein said engineered osteochondral graft comprises a matrix block and a first population of MSCs, wherein said first population of MSCs are press-coated on a top surface of said matrix block, and said first population of MSCs forms a cartilage layer on said top surface of said matrix block.

24. The method of **Claim 23**, wherein said engineered osteochondral graft further comprises an osteoinductive growth factor in an amount sufficient enough to elicit osseointegration.

25. The method of **Claim 23**, wherein said engineered osteochondral graft further comprises a second population of MSCs which are loaded in the remaining volume of said matrix block, wherein said second population of MSCs is in an amount sufficient enough to elicit osseointegration.

26. The method of **Claim 25**, wherein said engineered osteochondral graft further comprises an osteoinductive growth factor in an amount sufficient to elicit osseointegration.

27. The method of **Claim 23**, wherein said first population of MSCs are transiently or stably genetically engineered to express a gene product.

28. The method of **Claim 27**, wherein said gene product is a member of the transforming growth factor-β superfamily.